
Welcome everyone to the SBIR market research session. My name is Michael and the technical announcement for before we begin. Pulling into telecon my make sure to music your computer speakers. Also meet your telephone when you are not speaking and if your phone does not have a mute function on it, --*6 to mute and a mute your phone. The format today will include a briefing from our NASA discussion lead followed by a discussion and Q&A.. We will take all questions from the chat room which is located on the lower left of your screen. We will also take questions from the telephone line. To ask a question on the phone, click the raise hand icon on the top of your screen. Spoke we will record this event and there is a link in the chat room. Now I want to introduce you to Michael Dudley was a director of the NASA aeronautics research Institute and the SBIR mission directive representative.

Thank you Mike. Will come and I'm glad you are all able to join us. This activity is an experiment. It's a pilot program that we are conducting for the purposes of trying to solicit public opinion about NASA research activities. Today we're going to be talking about physics-based occupational tools. Erik also will be leading the discussion. The primary purpose of this activity is to hear from you and for you to engage any discussion. Because of procurement regulations we are not able to divulge any predecisional information. So primarily we're going to be talking about existing NASA research interests. Typically being pursued through various NASA programs but also through the small business innovative research program. Today, Erik will start out by providing some background technical information and give you a technical representative and lead for this activity. And hopefully answering your questions to the best visibility. But primarily we want to hear from you. NASA has different ways of trying to solicit public opinion. Typically we use request for information process to ask for public opinion about various NASA activities that tends to be a one way communication. What we're hoping to happen today is for everyone to engage in a dialogue and I strongly encourage the participants not going to engage in a dialogue with NASA but also with each other as we go through this activity. As Michael mentioned, you can input your questions to the chat room where we can do it verbally whichever you feel more comfortable with the session is being recorded and so for people that have not had the opportunity or don't have the opportunity to attend this live copy can go back and you the information at a later time. This will all be archived on the NARI website. For that I will turn it over to Erik and I'm grateful for him volunteering to lead this activity particularly the very first session we are holding. As a mentioned this is an experiment so please bear with us. With that Erik please take away.

Thanks Mike. I don't see my slides up yet. Here we go.

I'm from the aeronautics branch at the NASA Langley. And the tentative subtopic manager in this area for this year. Bill Heller is the assisting subtopic manager in this area. We alternate at Langley and for lead over the years and so bill and I have alternated the last couple of years leading this area. I'm going to go over and overview of what the technical area of the subtopic is and give a bit of history of the focus areas in previous years.

This is a summary of the subtopic as it's been written the last couple of years. Was named physics-based conceptual aeronautics design tools for FY 15. The main thing is that mass is investigating the potential of innovative propulsion and airframe concepts to try to improve the goals -- goals of fuel efficiency, reduce emissions for commercial transports. In order to achieve these goals, we looked at many of the advanced concepts in the and +3 timeframe which is around 2030 or so timeframe. NASA does a lot of conceptual design and analysis for airframe and propulsion concepts primarily we look at portfolio investments planning cut looking at portfolio technologies being investigated and how we think those stack up and how much benefit we think we can get out of those. We also look at developing new advanced concepts that provide a technology world -- the concept are able to leverage technologies and were able to decide what technologies are enabling for these types of advanced concepts. We also look at independent technical assessments of new concepts developed in other areas. In order to perform these activities, we need our systems analysis tool to have the best conceptual designs and analysis tools as possible. In recent years there's been substantial progress in incorporating more physics-based analysis into the conceptual design

process. This is made the analysis tools were applicable to the unconventional concepts. However there are many areas where we still have modeling gaps were improvements can be made. This is the modeling gaps that we are speaking -- seeking to fill through this route of opening this up to the possibility of innovation by small business.

As I mentioned, the subtopic has alternated the last few years between a Glenn Regan Langley. This year the subtopic content was led by Glenn. When it's led by Glenn it's more of a propulsion focus because that is more there area of expertise. When it's led by Langley has more of a airframe focus. This year the subtopic is a capabilities we're primarily -- things like weight and body estimates for hybrid electric propulsion systems and its components. Counterrotating open water performance, and multi-fidelity environment and tools. Advanced acoustic modeling and also the AI performance integration and some tools on the macro level addressing large-scale impacts that are primarily propulsion.

In the 2014 subtopic which was a Langley lead, this was written specifically looking at weight estimations to think to estimate relationships for structural analysis improving the fidelity and streamlining the process for structural analysis and weight estimating techniques for things like systems and equipment.

The 2012 subtopics content led by Glenn was similar to the 2014 subtopics looking at electric and Turbo electric performance and weight estimation methods and enhanced propulsion performance looking at higher-order effects, modeling and higher order and for mental tools. Sonic boom, combustion, acoustics.

Finally the subtopic goes back further but I'm only giving the last few years when it's been in a form that it is in now. In 2011 it was led by Langley and was more of a general focus looking at integrated variable fidelity, physics-based design and analysis tools and technology assessment and integration and evaluation. Just evaluation of advanced concepts.

That is all I wanted to go over. Primarily just to give feedback other than me talking. I wanted to get some background information for those who haven't been closely participating or following the process.

Thank you Erik. This is Deborah here. Our original sign was to take questions from the chat room first. Questions or comments. But I don't see any in their. Why don't we open it up on the telephone line in order to get some order here, if you notice at the top of your screen of participant -- there's a figure with an arm of. That is the reason I had. If anyone has a question or comment, these use that icon at the top and we will scroll through and call on you. I see a question from ask a question.

This is Mark page. Where in Irvine California. First of all I love the stuff. This is a worthwhile exercise. There is no question about it. Because we struggle to understand what the current state of the technology is and where it would go. Without falling back only on parametric models that couldn't the past. The physics-based stuff is awesome. One question I have is -- and apologies that I am new in this discussion. Do you already have in place a collection of tools that you consider your baseline?

Yes. We have a set of tools -- the primary tools in this area that everything else is built on. Our mainstay has been applied optimization system which is a mission performance. And then we built around that. For geometry, we do a lot with vehicle sketchpad open DSP aircraft was protection programs for noise production. Those are the tools that we have used for years as a core set of tools. We tend to be fairly them. We based in have been adding on capabilities to bring in more physics-based tools. We do more higher fidelity aerodynamic analysis now. We do kart 3-D pretty routinely as well as lower fidelity tools. At of panel codes. We're doing more with higher fidelity structural analysis. We do have an integrated set of tools particularly in the supersonic area. Have a tightly integrated set of tools that from the whole range of metrics for the vehicles we're looking at. We tend to try to fold tools into that existing framework wherever possible. We like to be able to talk to each other fairly easily.

And Erik, i remember from my old blended wing days, all of these guys. But I haven't been involved with you folks in many years. Are these codes open to US citizens texting or are these codes held internally within NASA? And these activities it inform them to get the fidelity up?

I guess it varies. Some of the tools are open source tools. We didn't develop or we have some MIT tools. Some of them are NASA tools which are open to US citizens. And some of them are only government use only. It varies.

Thank you.

As a follow-up, with this baseline set, what -- do have anything that comes to mind if the people who use these tools say I wish blank or I wish this could do this? Does that come up often? Do something stick out in your mind?

When -- last you may have an airframe focus -- when we had an airframe focus we did a structure focus. That was area we really identified as that we wanted to focus research in. Specifically why we did that.

And this is Mark page again. This might be a dumb question but doing these exercises ourselves, I'm trying to understand what the landscape is -- the competitive landscape of the teach future could be an attempt to optimize aircraft to those new missions. The thing I find constantly that are barriers -- first and foremost what the heck is an engine? A real engine? With the real stall limits? I think you guys are all over that. That is probably one of the biggest ones. Because engine companies publish something and they make you sign contracts before they give you an engine back. So getting data to even attempt something is difficult with engines whether to testing or gas turbine. It's frustrating. The other one I would say has stumped us many times is fixed weights related to transport or commercial aircraft. Where it is a military aircraft were the things are going to be bolted in or exquisitely declared that is one thing. But if someone says what is a typical jet interview with Kerry so many more what is a commercial jetliner interior way? Or a small airplane? We have seen colossal variability in those models and those numbers often are bigger because of fixed weights often have for bigger influences then the breakers of the structures model. They have big weight fractions and are fixed and to you if you get it wrong. Is anything happening in NASA on that?

I agree with you. Weights components -- subsystems and things like that are an ongoing area. More work needs to be done. We have been putting some of that into the calls in the last couple of years. The hybrid electric components is a new area so there's not a lot of data there. That's been in the calls over the last couple of years. Weights estimates for hybrid electric components. And also performance analysis of hybrid electric systems like parallel hybrids or you have more degrees of freedom than you did with just a fuel-burning engine is an ongoing area of method development. So -- in terms of engine performance modeling I didn't mention and PSS the numerical propulsion simulation. It's another core use of our methodology to do analysis of the engine. In order to get those optimum design curves you are need to know about the engine where it's difficult to know the efficiencies of the components. It's hard to get the information

I would say that in my experience the thing that is stumped me and my colleagues most often in understanding -- particularly turbine engines or turboprop engines is the conditions -- what is the highest I can push this? The rubberized models sometimes don't tell you when you've got lapses with density and things like that. There comes a point for you can sustain a fine. And the models are completely current of that typically. And having a physics-based model that such as on that that expertly says if I have this pressure ratio cotton this fuel species and everything else than without hydrogen spiking I can keep it but for to this altitude. That would be helpful. And things like hydrogen spiking models would also be useful with the high altitude interest.

Those are good comments.

I think we have haunted the phone long enough. We will pass it back.

This is Deborah. We have a couple of questions in the chat room. I'm going to read the first one. What type of physics-based tools are being used in rotorcraft research from structural design and analysis standpoint?

That rotorcraft has been an area that we have done much work in. There are other some topics that are specifically focusing on rotorcraft. I would say look into that area. Susan Gordon and NASA Langley is

leading the rotorcraft research here. She is someone to get in contact with about that. Otherwise I can't really comment too much on rotorcraft.

This is Mike. For the benefit of the audience, this is the first of many of these technology market research virtual meetings that we're planning on holding. This is the first one that we have scheduled but if those I assume he went to the NARI website to see the calendar of topics that we hope to have discussed. We have not identified NASA technical representatives for all of the talks. One of the other talks we're hoping to get scheduled would cover rotorcraft technologies. All I can do is advise you to standby and go back and keep checking the calendar as we get more presenters scheduled. And if we can get one for rotorcraft technology hopefully that should help into some of those questions.

It's called a vertical lift.

Yes. The name has been changed to vertical lift as opposed to rotorcraft.

Another question is when will the next briefing on structural efficiency be given? I will answer that. Mike mentioned the website. It is in the chat room twice. We are still in the process of scheduling the session so please check back daily and as we schedule those, I will put them into the table as soon as possible.

Moving on we have a question on the phone.

I'm from intelligent automation. I'm following question from something mentioned in terms of the primary or mainstage software. You mentioned flops being there in the solicitation that we have seen. There is been mixed opinion in terms of from we together as in some of the solicitation say you want to get away from flops analysis and the others want to make use of it. I'm confused as to are you thinking of flops as something that would remain a mainstay and you want to add on to it? Or do you want to especially pretty in the physics-based tools, the you want to go away from flops and look at other design software?

We do have an effort that is in the planning stages of TC programs to transition from flops into a newer system. We're calling it lease at this point. That would be to get away from the modeling structure that flops is now into go more toward a modular structure to try to update the mission analysis and be able to handle more modern architectures like hybrid electric aircraft and different types of things like that. Up to this point we have continued to use flops. It's a multi-system so it's capable of analyzing all of the aspects of aircraft. Weight predictions, aerodynamics, however it is only truly valid for more conventional types of the you try putting on the module configurations the more you will get outside -- outside the range of validity. The work we've done is to bring in more physics-based analysis and to supplement those pieces of flops while still maintaining the strength of it like the mission analysis and fuel balancing optimization and things like that. We have worked at bypassing pieces of it while retaining its strengths. We're looking at going to a more modern type of architecture.

Thank you. That answers the question.

Are there any other questions out there from folks on the telephone? I don't see -- -- I see a couple. Let's go back to DZYNEtech first.

This is a follow-up to what was last discussed about flops. Is there anything currently on the market in terms of -- there are lots of different codes out there on the market that NASA could potentially buy and use. I was wondering what is going on there. Has NASA assessed these codes and decided for one reason or another if they don't fit the bill? Or like aircraft performance program or and of course there are Corporation ICs on the purpose of list. They have software. What's going on there with assessing what exists and any kind of where works roster won't work for us in where does that stuff like behind?

I would say that it's part of the current ongoing process. Ongoing discussion about what capabilities are we looking for and what's available and what's not available. It's definitely part of the process because it's always better to use what's already available rather than try to reinvent the wheel in that area.

The next question on the phone?

I have a bit of philosophical question in terms of long-term. I noticed there was some significant work done at NASA in academia on multidisciplinary design architecture in the past. Of late I have seen a focus basically on modeling and analysis and improving the fidelity and runtimes. We believe having worked on the optimization architecture as well that there is a significant amount of Toshiba in terms of efficiency by getting to better architecture. But it seems to have been lost somewhere. We were wondering is it something you consider as a future option? Or is that not that important in your opinion?

Dooming an option in terms of SBIR solicitation or in terms of continued research?

Continued research. Better architectures maybe investigating the more thoroughly and looking especially I think many of the architectures were developed with conceptual level of analysis. But with the advent of physics-based modeling company -- can use to me?

Yes.

The advent of physics-based modeling, there is a possibility of enriching the architecture or improving upon them. I'm not sure if that is an area of interest for NASA at the moment.

I think that would fit into the work being done in the MDA oh area of one of the goals of that develop meant was to try to have something which was fairly modular in terms of MDA O architecture. If you develop new ways of doing the optimization process or new ways of information flow that it was supposed to be an architecture which you can try out your concept and improve upon them. That is the goal of that area. I don't know if you feel that -- if it is meeting those goals are not.

I was talking a bit in terms of the solicitations and the directions of research we've seen from NASA. For instance the one you mentioned today as well in terms of the trust area Vanessa is pursuing. It cannot find a lot of emphasis on the new architecture per se. I was wondering if that area is still an area you think -- do think it's a solved problem? I know there is work on open MDA O that has been going on and NASA have invested a lot of effort in that area. But I was wondering about the future whether there is plan for improving upon -- not just from the software point of view but from the MDL architecture point of view.

I think there is still interest in that area. In terms of specific solicitations, the resources are limited. We have intended to -- ICCAT we can't offer solicitation which asks for everything under the sun so we've tried to focus on three specific critical areas in many cases. It doesn't mean there's not interest in more general research in MDA oh out rhythms. -- Algorithms.

Thank you.

We are trying to fix the closed captioning for you. Sorry about that. Are there any other folks on the line who want ask a question? I don't see anything in the chat room. Anyone on the line? Before we close out I will say this has been recorded and we will posted on to the website with the schedule is. Again that is -- I will put it into the chat room one more time. The event was closed-captioned. And forcefully -- unfortunately we were unable to get the feet over to like we'll have the transcript on the website along with the recording. And at least one more question in the chat room.

Why not use FEA and CFD tools? What's wrong with them?

I would say that we definitely use CFD tools. We've gotten recently where we are using them on a regular basis. Particularly in areas where there is strength can be utilized like in sonic boom prediction and aerodynamic analysis for unconventional configurations or the lower tools are not as applicable. We have not -- we're a bit behind our ability to use FEA tools. But there been a lot of attention in this area over the last couple of years. A lot of work has been put into trying to streamline the process from going from our geometry tools to developing a full structural analysis capability in a more automated fashion. Work is ongoing in that area and it's an area we have a lot of interest in. So there has been a lot of work in trying to

do more physics-based analysis with things like CFD analysis. Is it a trade-off because we are trying to do conceptual design and rapid analysis. So we apply the tools wherever we think we can get the most benefit from them without using a big hammer.

Okay. Anyone else? Last chance before we close out. Eric is there any last words you would like to communicate to the audience before I pass it back over to Mike Dudley for final closings?

I would like to thank everyone for their time and for their questions. I think if anyone has other questions if they can feel free to contact anyone from the program. And I welcome any continued feedback. So don't like this is the last opportunity to ask questions.

Okay. Thank you Eric.-- Erik. We appreciate you being the guinea pig for our first attempt at this. I also want to thank the participants for joining us. I apologize for some of the roughness of this activity. But usually when we try something new like this, we generally have a few glitches that we have to deal with. Although we do have a lot of experience doing virtual symposiums and all sorts of things. You can see posted on our website. This is our first attempt at what I will call a quick response interactive virtual meeting to try to do an outreach to the public. And I want to particularly thank the folks from design Tech and intelligent automation they were some of the primary or the more active participants. If any of you online are going to engage or attend any of the future seminars, I strongly encourage you to participate as actively as possible. The real benefit from this is not so much hopefully -- there is some benefit to hearing NASA talk but really we are trying to reach out to you and understand your perceptions and your opinions about what NASA is doing. And we're happy to share what we are doing and what our interests are. But it is your input that really is the information and the value we are seeking. Again I strongly encourage your participation. These tools are unfamiliar to some people. There sometimes a reluctance to engage with these modes of communication that you maybe not as comfortable with. And so I encourage you to participate in as many of these as possible. And get comfortable with them because we really want to hear from you. As I mentioned we do the RFI and that is a valuable source of information. But we strongly believe that it is the real-time interactions -- you talking with us and with each other is where the real issues and real valuable information is going to surface. With that, I'm going to bring this session to a close. Again my thanks to everyone including Deborah and Mike who have helped with some of the technical and of it. And -- you mentioned we're going to try to get this closed caption which was caption -- will get posted if you want to go back and check that out. With that, unless there is any last-minute I forgot, I think you all very much.

Thank you. [Event Concluded]